

CHIRAL DEGENERACY IN TRIAXIAL ^{104}Rh

C. Vaman^a, T. Koike^a, K. Starosta^b, D. B. Fossan^a

^{a)} *Department of Physics and Astronomy, SUNY at Stony Brook, NY 11794, USA*

^{b)} *Department of Physics and Astronomy and National Superconducting Cyclotron Laboratory, MSU, East Lansing, MI 48824, USA*

A new region of chirality has been recently identified at $A \sim 100$ following a series of experiments. Near degenerate doublet $\Delta I=1$ bands having identical intrinsic configuration and the same parity have been discovered in odd-odd $^{102,104,106}\text{Rh}$ [1, 2] and in odd- A ^{105}Rh [3] isotopes. These doublet bands can all be understood in terms of geometrical picture, namely spontaneous formation of handedness or chirality[4] in the body-fixed reference frame. Chiral geometry is realized when high- j particle and hole are coupled to a triaxial core leading to mutually perpendicular orientation of three angular momenta, namely those of the single particle and collective rotation. On the other hand, the nuclear Hamiltonian is expected to be invariant under the symmetry operation of exchanging the right- and left-handed systems. In consequence, in the laboratory frame, doubling of rotational states results in degenerate bands of the same intrinsic structure. The best example of this phenomenon until now, was found in ^{104}Rh [1] with two $\Delta I=1$ bands built on the $\pi g_{9/2} \otimes \nu h_{11/2}$ configuration. Overall energy separation between the same spin states of the two bands is $\sim 70\text{keV}$ and a remarkable $\sim 2\text{keV}$ degeneracy is observed at spin $I=17$. The $^{96}\text{Zr}(^{11}\text{B}, 3n)$ reaction in a Gammasphere experiment was used to populate states in ^{104}Rh , the heaviest Rh isotope easily produced with xn fusion-evaporation reactions. A partner band has been newly identified that is linked to the negative parity $\pi g_{9/2} \otimes \nu h_{11/2}$ yrast band. DCO analyses of the linking transitions establish the relative spin and parity of the partner band to the yrast band experimentally confirming the near degeneracy of these two bands.

In the $A \sim 130$ region, the doublet bands observed in odd-odd nuclei are all built on the $\pi h_{11/2} \otimes \nu h_{11/2}$ configuration[5], which consists of unique parity high- j shell. The valence proton and neutron has a particle like and hole like character, respectively. In the new chiral mass region, the valence proton and neutron play a reversed role. The discovery of the new island of chirality surrounding ^{104}Rh enhances the validity of geometrical interpretation of nuclear chirality. The observation of chirality implies the existence of stable and sizable triaxiality in this transitional nuclei region.

References

- [1] C. Vaman *et al.*, Phys. Rev. Lett. **92**, 032501 (2004).
- [2] P. Joshi *et al.*, submitted to Phys. Lett. B.
- [3] J. Timar *et al.*, submitted to Phys. Lett. B.
- [4] S. Frauendorf, Rev. Mod. Phys. **73**, 463 (2001).
- [5] K. Starosta *et al.*, Phys. Rev. Lett. **86**, 971 (2001).